Committee on Earth Observation Satellites

The CEOS Ocean Variables Enabling Research and Applications for GEO (*COVERAGE*) Initiative:

Status Overview

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NASA

CEOS SIT Technical Workshop

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Jet Propulsion Laboratory, California Institute of Technology

The CEOS COVERAGE Initiative

- **CEOS endorsed COVERAGE initiative** at SIT-32 (April 2017, Paris) as a 3 year pilot project
- **Collaborative effort within CEOS** with the 4 Ocean Virtual Constellations (SST, OST, OCR, OSVW) and GEO projects (MBON, Blue Planet) to enable more widespread use of ocean satellite data in support of applications
- Provides a **coherent, cross-cutting, focal activity** *(not a new VC or* WG) aligning with and promoting the advancement of CEOS programmatic objectives, including FDA efforts
- **COVERAGE is informed by and a response to known needs of the ocean community** for improved, more integrated data access for societal benefit in support also of SDGS relating to marine biodiversity & ecosystem management
- **COVERAGE aims to develop a data rich platform** for more seamless delivery of analysis ready ocean data to demonstrate the value added of multivariate ocean data integration in support of science, applications, and public engagement
- **Tech. Platform for improved, integrated ocean data access utilizing emerging data management and cloud capabilities**: "fusion environment" for multi-parameter observations, available in near-real-time, collocated to a common grid, thematically organized and available via value-added data services (data discovery, visualization, subsetting)
- **Stakeholder Beneficiaries**:

  Internal: Ocean VCs, WGISS *External*: GEO-Blue Planet, GEO-MBON, UN/IOC GOOS

COVERAGE Activities

- Advisory Board developed with cross-agency and stakeholder representation

  Participants include: NASA, NOAA, CNES, EUMETSAT, Copernicus, Australian Bureau Meteorology, Integrated Marine Ocean Observing System, Sargasso Sea Commission, CEOS Ocean VCs, and WGISS

- Stakeholder Engagement & Presentations since SIT-32 (April 2017)

  BP symposium, GHRSSTXVII, IMOS, EOSDIS, CNES, NOAA, IOOS, MBON, SSC, CMEMS, UNDP-4M

- Project Initiation – October 2017
  - COVERAGE Phase A project with NASA support
  - Project core team assembled & Project infrastructure in place
  - Workshop series proposal in process in collaboration with Sargasso Sea Commission

- COVERAGE has a 4-part development concept
  - Phase: A. Scoping (6mo). B. Prototype Development/Evaluation (1yr). C: Full system development (1yr). D: Testing/Evaluation & transition to operations (6mo)
  - Reflected in COVERAGE inputs to CEOS 2017-19 Work Plan

- Phase A work plan key elements (next 6 months)
  - Detailed technical scoping, use case gathering & requirements analysis
  - Inventory of target datasets, providers, interfaces
  - COVERAGE system technical architecture, including CEOS and data provider interoperability considerations
  - Collaborative arrangements & ongoing stakeholder engagement

COVERAGE Data Product Inventory

Candidate interagency satellite data products across the 4 ocean VC parameters (SST, Winds, SSH, Ocean Color) for potential inclusion in COVERAGE application as a coherent set of 0.25 degree, global baseline products

- Have we missed any key items?
- Recommendations for collaboratively refining this list
- Considerations: line-up manageable, of quality, and adds-value to each other
- COVERAGE satellite data profile ("*Analysis ready*" products)

Spatio-Temporal Coverage Considerations							*"Analysis Readiness"*		
Spatial Coverage	Spatial Resolution	Spatially GapFree	Temporal Frequency	Latency	Temporal Coverage	Temporal Overlap with other	Accuracy Validated/Peer Reviewed	Interoperability (file, metadata)	Ease of Access
Global	0.25	Yes (ie. L4)	daily	NRT	Multi-Year	High	Yes	Yes	High

Some Observations

- Manageable number of good options for all parameters
- Ocean Color: paucity of L4 gap-free products
- Data Access: fine but some heterogeneity
  - Protocols – ftp common denominator (Scope for THREDDS?)
  - Registration: Copernicus and NASA URS (How to handle in COVERAGE?)

Limitations/Caveats

- Currently exclusive focus on US & EU agency datasets. Possibility of including data from other agencies (JAXA, ISRO, CMA)?
- Support for higher spatial resolution products?
- Support for additional parameters and derived products?

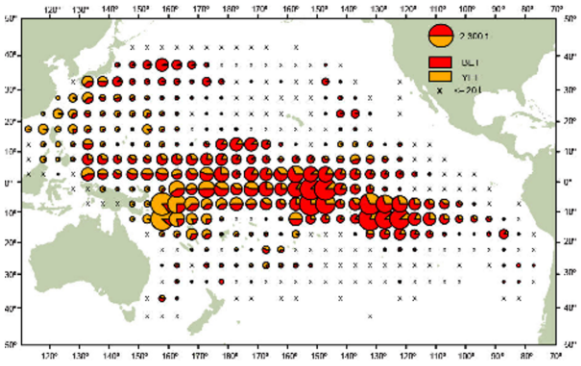
COVERAGE Pilot Applications in Support of GEO-MBON & B. Planet

Rationale

- Biological and Resource Management Communities – interest in application of EO data but limited expertise/capacity
- Tools supporting:
  - UN-SDGs (14 in particular) related to marine biodiversity, ecosystem based management & sustainable fisheries
  - Future measures resulting from ongoing UN negotiation of a new marine biodiversity treaty for areas beyond national jurisdiction (ABNJ)

High Seas & Regional Fisheries Applications involving integration of ocean remote sensing, physical model and in-situ datasets for operational decision support and research investigations

- Habitat analysis for Highly Migratory Species (HMS)
- Tuna Spatial catch forecasting
- By-catch mitigation



Key question: extent and mechanism by which environmental variability over a range of scales affect stock structure, drive dynamics and influence vulnerability to fisheries

Stakeholder agencies: eg. IATTC (RFMO), NOAA/NMFS

Supporting Data

- Monthly spatial catch/effort time series by species, aggregated 1 & 5deg, 1952-2017
- Electronic tagging datasets: high resolution trajectory-profile series
- NRT AIS vessel movement data by category (daily, since 2007)

COVERAGE Pilot Applications in Support of GEO-MBON & B. Planet

Summary of use cases highlighted by MBON in initial discussions:

- SEASCAPES – access to ocean remote sensing data (Sea level Anomaly, SST, Winds, and CHL-A) and services via COVERAGE
- OBIS – explore interfaces to Ocean Biogeographic Information System
- EMUs – Ecological Marine Units based also on remote sensing data time series
- Ocean Color and other data sets data available in near real time to support a wide range of monitoring applications (eg. algal blooms events)
- Support derived products such as anomalies, climatologies, gradients, currents potentially important for marine biodiversity/ecology applications

Functionality needed to support marine biodiversity-type applications:

- Connectivity to OBIS as a centralized repository of marine biogeographic data
- Ability to flexibly visualize, collocate, and extract time series of in-situ biological and satellite observations for regions of interest (user defined areas, EEZ/MPA polygons)
- GUI and APIs to both interactive and automated/script-based data access
- Higher/native resolution satellite data desired

COVERAGE Phase A Status

Activity	Status	Product
• Review of candidate baseline interagency Satellite data products for inclusion in COVERAGE including documentation of interfaces and volumes	Completed	Inventory XLS
• Tests to Search for inventory satellite datasets via integrated CEOS search interfaces - coordinating with CMEMS and ESA for publication of CMEMS metadata in FedEO	Completed	
• Inspection of select *in situ* datasets for possible inclusion in COVERAGE including documentation of interfaces and volumes	Approaching Completion	Draft Inventory XLS
• 25km edition of the GHRSST MUR-SST v4.1 product produced	Completed	Processed series
• Prototype implementation of MUR's Multi-Resolution Variational Analysis (MRVA) wavelet technique for L4 Ocean Color and as a consistent gridding/scaling algorithm for COVERAGE including MODIS A and VIIRS	Completed	Sample products
• COVERAGE system architecture design work, including: interfaces to data providers and metadata holdings at source and via CEOS; core services for data discovery, extraction, visualization ("MVP" – Minimal Viable Product)	Ongoing	Design spec
• System engineering work supporting design activity: Use cases and requirements development Integration of components under development via other NASA Tech. projects	Ongoing	Documentation
• Stakeholder engagement: Advisory Board, GEO-MBON ("Seascapes"), Blue Planet, SSC, CEOS and other reporting - Attendance of 4th Blue Planet Symposium, Toulouse, 4-6 July (poster presentation) - Preparations for COVERAGE workshop at CEOS-SIT-TW, Darmstadt, 12 September	Ongoing	-